HAND-OPERATED SWEEPING MACHINE

[0001] This application claims the priority of German application no. 103 09 991.3, filed February 28, 2003, the disclosure of which is expressly incorporated by reference herein.

BACKGROUND AND SUMMARY OF THE INVENTION

[0002] This invention relates to a hand-operated sweeping machine with two circular brooms that are mounted in the front area and are equipped with a motor drive, driving them to rotate in opposite directions.

[0003] A sweeping machine equipped with a driving means is known from German Patent DE 19617986 A1. The drive of the circular brooms is implemented by driving means which transmit the driving forces derived from the forward motion to the circular brooms. As an alternative, it is stated in the publication cited above that the circular brooms may also be driven by an electric motor drive. An electric motor drive has the advantage that the circular brooms will rotate at an adequate speed even if the sweeping machine only transverses slowly or is stopped to sweep out a corner or the like.

[0004] In practice, a battery must be provided for an electric motor drive within a sweeping machine because the sweeping paths, in particular in the case of exterior installations, are usually too long to allow a power supply by way of a cable. In the case of battery-powered operation, the problem may occur whereby the charge of the battery drops so much during sweeping a job that sweeping operation is no longer possible, for example, if the battery has not been charged

for a sufficiently long period of time. To be able to continue the sweeping operation, the user must either replace the battery or connect the sweeping machine to a charging unit and wait until the battery is charged again.

[0005] An object of this invention is to permit use of a sweeping machine equipped with a motor drive even when the motor drive is not functioning.

[0006] This object is achieved by the fact that in addition to the motor drive for the circular brooms, driving means which transmit the driving forces derived from the forward motion to the circular brooms are provided and means for automatic interruption of a connection are provided between the motor drive and the driving means.

[0007] This design makes it possible to continue to use the hand-operated sweeping machine even when the motor drive is not in operation, e.g., because there is no power supply, i.e., the battery charge is too low or the available cable length has been exceeded. In these cases, the sweeping machine can be used for manual operation so that the circular brooms can be driven by the forward motion. The means for automatic interruption of the connection between the motor drive and the other driving means ensure that the motor drive is functional even when the sweeping machine is stopped or is moving forward very slowly. The motor drive does not have a retroactive effect back on the other driving means and therefore does not cause any unwanted forward motion of the sweeping machine.

[0008] In one embodiment of this invention, a separate motor drive and separate driving means are provided for each circular broom. This facilitates turning corners and executing pivoting movements of the sweeping machine.

[0009] In another embodiment of this invention, an overriding coupling which allows the circular broom to run ahead with respect to the driving means is situated between the driving means, which transmit the driving forces derived from the forward motion, and the circular broom. In this embodiment, the drive which is running at a faster speed transmits driving forces to the circular brooms. This is usually the motor drive, but it is also possible for the user to drive the circular brooms to execute a faster rotation than that induced by the motor driving means, i.e., by moving the sweeping machine especially rapidly.

[0010] In another embodiment of this invention, an overriding coupling is provided between the circular brooms and their motor drive, allowing the circular broom to run ahead. This achieves the result that when the motor drive is unable to function because of lack of a power supply or due to some other defect, the circular brooms and the drives which are then effective need not drag the motor drive.

[0011] In another embodiment of this invention, a sweeping roller aligned across the direction of motion is provided, this roller being equipped with a motor drive and driving means being provided so that driving forces derived from the forward motion can be transferred to the sweeping roller; in addition, means are also provided for automatic interruption of a drive connection between the driving means and the motor drive of the sweeping roller. If the sweeping roller

is motor driven, the sweeping function can still be maintained even when the sweeping machine is moving very slowly or even at a standstill. Here again, there is the problem that the motor drive may not be functional because the battery is too low or there is a lack of power supply or because of a defect. In this case, the driving means then drive the sweeping rollers which derive driving forces from the forward motion and transmit them to the sweeping roller.

[0012] Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG 1 shows a vertical section through a circular broom of a hand-operated sweeping machine in accordance with an embodiment of the present invention, and

[0014] FIG 2 shows a schematic diagram of a drive of a sweeping roller of a hand-operated sweeping machine in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

[0015] The circular broom 10 shown in FIG 1 is one of two circular brooms mounted in the front area of a hand-operated sweeping machine. The sweeping machine is designed essentially according to the sweeping machine known from German Patent DE 19617986 A1. This sweeping machine has two circular

brooms mounted in the front area, rotating in opposite directions about approximately vertical axes of rotation that are preferably inclined slightly forward. The circular brooms sweep directly toward the center and toward the rear into the sweeping machine. The dirt is preferably swept toward the rear into the housing through a sweeper plate and is picked up there by a sweeping roller before being sent onto a collecting container. In this embodiment, each circular broom 10 is equipped with its own drive as illustrated on the basis of FIG 1.

[0016] The circular broom 10 has a base body 11, which is designed as an injection molded plastic part. This base body 11 is essentially pot shaped. A ring of bristles 13 is embedded in the edge 12 of the pot-shaped base body 11 which is open toward the bottom. The circular broom rotates about an essentially vertical axis of rotation 14, which is preferably inclined slightly forward in the direction of travel of the sweeping machine.

[0017] The axis of rotation 14 consists of a journal 15 on which is mounted a drive element 16 that is manufactured as an injection molded plastic part. The drive element 16 has teeth 17 in its lower area which engage with a screw 18. The screw 18 is in a rotationally fixed connection with a roller 19 mounted on a journal 20. The journal 20 is part of an offset axle 21 which is rotatable about the axis of rotation 14 in the journal 20. The roller 19 is thus a following roller which is set behind the axis of rotation 14 with respect to the direction of travel. The roller 19 thus always drives the drive element 16 in the same direction.

[0018] The base body 11 of the circular broom 10 is rotatably mounted on the drive element 16. Between the drive element 16 and the base body 11 is arranged a free-wheeling coupling 22, preferably a so-called free-wheeling roller. This free-wheeling coupling 22 is designed so that the base body 11 of the circular broom 10 can run ahead in the direction of driving the driving element 16 but rotation in reverse is blocked. The same function is also achieved when a free-wheeling coupling is provided between the worm gear 18 and the roller 19.

[0019] The base body 11 is provided with a screw wheel 23 which engages with a screw 24 of an electric motor 25. The electric motor 25 drives the screw wheel 23 and thus drives the base body 11 of the circular broom 10 in the same direction of rotation in which the circular broom 10 is also driven by the drive element 16.

[0020] When the electric motor 25 is turned on, it drives the circular broom 10 to rotate, even if the roller 19 is stopped. The free-wheeling coupling 22 allows the circular broom to run ahead of the drive element 16. If the electric motor 25 is not running, e.g., because the battery has discharged or because no electric power supply is possible or because the motor 25 is defective, then the circular broom 10 is driven by the roller 19, the worm gear 18 and the drive element 16, 17. It is thus possible to continue operating the sweeping machine even when there is no electric power supply and for example a sweeping job that has been started can be completed.

[0021] In order not to drag on the electric motor 25 via the rollers 19 when there is no power supply or when there is a defect in the electric motor, an

overriding coupling 27 is provided between the circular broom 10, i.e., the base body 11 of the circular broom 10 and the electric motor 25, this coupling preferably being designed as a free-wheeling roller. This overriding coupling is designed so that the circular broom 10 can rotate at a higher rotational speed than that set by the motor 25. This yields the result that if the electric motor 25 fails, it need not be dragged along too. In addition, it is also possible to move the sweeping machine manually quickly enough that the circular broom 10 will rotate at a higher rotational speed than that determined by the electric motor 25.

[0022] The two overriding couplings 22, 27 are preferably designed as free-wheeling rollers, as mentioned above. However, other designs of overriding couplings can also be used, e.g., ratchet couplings or friction couplings or the like.

[0023] Instead of the overriding coupling 27, which automatically interrupts the connection when the circular broom 10 is running faster than the worm gear wheel 23, other means may also be provided for interrupting this connection. For example, it is possible to arrange and/or design the electric motor 25 so that the worm gear wheel 24 is engaged with the gear wheel 23 only when there is an electric power supply or the power is turned on. As soon as the power supply stops or fails, the connection between the circular broom 10 and the electric motor 25 is interrupted so the electric motor 25 need not be dragged along. In a modified embodiment, instead of the overriding coupling 27, a device is provided which cancels the drive connection when the circular broom 10 is rotating at a faster speed than the gear wheel 23 driven by the electric motor 25. It is possible

here to make use of the fact that the direction of the force transmitted between the worm gear 24 and the gear wheel 23 has changed.

[0024] As mentioned above, in the preferred embodiment, a sweeping roller 30 is connected downstream from the circular broom 10 and is preferably driven in such a way that it sweeps the bottom in the direction of travel, i.e., in the opposite direction from a wheel rotating on the floor. The sweeping roller 30 is driven by one or both of the wheels 31, 32 with which the central or rear area of the sweeping machine sits on the floor. The sweeping roller 30 has a shaft 34 which is equipped with bristles 33 which are mounted in a housing of the sweeping machine. In the simplest embodiment, the sweeping roller 30 is driven by only one of the two wheels, e.g., the wheel 31. The wheel 31 is provided with a gear wheel 35 which meshes with a gear wheel 36 in a rotationally fixed mount on the shaft 34. To achieve the result that the sweeping roller 30 is driven in a direction opposite the usual sweeping direction when the sweeping machine is moved or pulled in the reverse direction, a free-wheeling coupling 37 is provided between the gear wheel 35 and the wheel 31. When the sweeping machine is moved in reverse, the sweeping roller 30 thus remains standing or rotates further slightly due to its inertia.

[0025] In the exemplary embodiment according to FIG 2, the sweeping roller 30 is driven by an electric motor 38 which drives a gear wheel 39 that engages with the gear wheel 36 of the shaft 34 of the sweeping roller 30. The sweeping roller 30 is thus rotating even when the sweeping machine is stopped, i.e., the wheel 31 is not rotating. In this case, the free-wheeling coupling 37 interrupts the

connection between the wheel and the motor 38 so that the motor 38 does not act as a traversing drive, i.e., it does not drive the wheel 31.

[0026] If the electric motor 38 fails, i.e., because the battery is too weak or there is no electric power or because of a defect, the sweeping roller 30 is driven by the wheel 31 in the forward direction in one method. In order not to have to drag the motor 38 in this situation, a free-wheeling coupling 40 is provided between the electric motor 38 and its gear wheel 39 in this exemplary embodiment. However, this free-wheeling coupling can be omitted if the electric motor 38 does not present any great resistance to turning and in particular if it does not have any self-locking gear stage. If in addition it is necessary to ensure that the sweeping roller will be driven in the same desired direction of rotation even if the sweeping machine is being pulled or driven backwards, even if the electric motor 38 is not functioning, then according to the exemplary embodiment depicted here, another drive is provided for the sweeping roller 30 and is derived from the opposing wheel 32. This wheel 32 is connected to a gear wheel 41 which meshes via an intermediate wheel 42 with a gear wheel 43 which is in a rotationally fixed mount on the shaft 34 of the sweeping roller 30. Depending on the direction of movement of the sweeping machine, the wheel 31 or the wheel 32 then drives the sweeping roller 30 in such a way that it always rotates in the same direction of rotation, regardless of the direction of travel. To ensure that the electric motor 38 does not act on the wheel 32, another overriding coupling 44 is provided between the wheel 32 and its gear wheel 41. The overriding couplings 37, 40, 44 are preferably designed as free-wheeling rollers, but other

designs may also be provided. For example, ratchet couplings or friction couplings may also be used.

[0027] In the simplest embodiment, namely when the sweeping roller 30 is not driven when the sweeping machine is pulled backward in the event of failure of the electric motor 38 and in which the motor is dragged along when the sweeping machine is moved forward when the electric motor 38 has failed, it is sufficient to have an overriding coupling, namely the overriding coupling 37 between the wheel 31 and its gear wheel 35. If the electric motor 38 is not to be dragged in the event of a motor failure, the second overriding coupling 40 is necessary, and is arranged between the electric motor 38 and its gear wheel 39. If another positive drive for the sweeping roller 30 in the previous direction is to be provided in addition in the event of failure of the electric motor 38 and a reverse movement of the sweeping machine, then the second wheel 32 must be incorporated into the overall drive system in the manner described here. In this case a third free-wheeling coupling 44 is necessary, although it may also be situated between gear wheel 43 and the shaft 34 of the circular broom 30.

[0028] The foregoing disclosure has been set forth merely to illustrate the invention and is not intended to be limiting. For example, although electric motor drives are mentioned above in the exemplary embodiments, this invention is not limited to the use of electric motors. Instead, any type of motor may be used, in particular internal combustion engines. Since modifications of the disclosed embodiments incorporating the spirit and substance of the invention may occur to persons skilled in the art, the invention should be construed to

include everything within the scope of the appended claims and equivalents thereof.